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MONTANA COMMUNICATIONS STUDY

MONTANA TELECOMMUNICATIONS ADVISORY COUNCIL

STATE OF MONTANA

VOLUME I
AUGUST, 1982

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Montana Communications Study

Montana Telecommunications Advisory Council

State of Montana

Volume I

August 1982

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MONTANA COMMUNICATIONS STUDY

MONTANA TELECOMMUNICATIONS ADVISORY COUNCIL
DEPARTMENT OF ADMINISTRATION
STATE OF MONTANA

August, 1982

VOLUME I

Preparation of this study was made possible, in part, by a grant from the U. S. Department of Commerce, National Telecommunications Information Administration, Public Telecommunications Facilities Program, Washington, D.C.

DEPARTMENT OF ADMINISTRATION
COMMUNICATIONS DIVISION

TED SCHWINDEN, GOVERNOR

ROOM 222 - SAM W. MITCHELL BUILDING

STATE OF MONTANA

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HELENA, MONTANA 59620

September 1, 1982

Mary Dinota, Program Officer
Public Telecommunications Facilities Program
Room 4078 Main Commerce Building
U. S. Department of Commerce
14th & Constitution Avenue
Washington, D.C. 20230

Dear Ms. Dinota:

We are pleased to transmit to you the attached "Montana Communications Study".

This study has already had far ranging results for the State's management and planning of its telecommunications network. Telecommunications, as you know, is a rapidly changing field. Consequently, while a single plan can serve as a guide, it only represents a point in time relative to the dynamic changes taking place nationally as well as in the State of Montana.

The primary benefit of this study has been its guidance to our Communications Division in its development of the State Telecommunications Network. Although the publication date for this study is August, 1982, its preliminary findings were a topic of intense interest as early as the winter of 1981 when the State Legislature, with great insight, saw fit to create a two-year telecommunications planning fund for the Communications Division with a mandate to proceed with comprehensive telecommunications planning. Since that time, the following activities, based on this study's recommendations, have occurred:

TELEPHONY

We have approached telephony on three specific levels. First, we have decided to proceed with Requests for Quotations (RFQs) issued to qualified vendors to solicit quotes for switches in the State Telephone System. On July 20, 1982, DATATEL, Inc. "cut-over" a digital electronic switch at Western Montana College in Dillon. On May 7, quotations were opened from seven companies for the new Justice Department and Montana State Library Building switch. Mountain Bell received the award for this job and work is progressing towards a September "cut-over". Responses to an RFQ were opened July 23, 1982,

AN EQUAL OPPORTUNITY EMPLOYER

for the Helena Capitol Complex, Eastern Montana College, Montana State University, and the University of Montana, with nine vendors competing.

Second, we are, as a result of our switch replacement program, involved in network management planning. This effort involves exploration of systems which will be necessary to establish adequate control of the State Telephone System in areas such as least-cost routing of telephone calls, automated billing procedures, and maintenance of a data base enabling monitoring of traffic and an up-to-date inventory of equipment.

The third area of planning for telephony involves an analysis of our transmission methods. Employing consulting engineering assistance, we are preparing a detailed feasibility study of alternative transmission methods to carry voice, data and text. This project involves an analysis of present system capabilities and costs and comparative studies of microwave, fiber optic, and satellite transmission alternatives.

DATA COMMUNICATIONS

A significant consideration in planning for alternative transmission methods is the capability of such technologies to transmit electronic data. Our objective in this area, as proposed by the Montana Communications Study, is to define the existing networks and develop a volatile data base enabling better planning to maximize the ease, quality, and cost savings in data communications. An important aspect of our transmission study is determining optimum desirable data speed requirements and the feasibility of a closed loop circuit.

LAND MOBILE RADIO

The immediate concern for planning is the development of an automated data base so that advanced planning can proceed. Automated files are being developed to track and inventory State and local government radio facilities, frequencies, and status of license applications to the FCC.

The 1981 Legislature appropriated funding for high band pilot projects for the Highway Department and Montana Highway Patrol. Our planning currently involves an analysis of the results of these projects and the potential for further conversion of State and local governments to the high band spectrum. An important feature of this activity is the development of more efficient dispatching methods.

We have also determined to create a statewide mutual aid radio frequency in order to enable State and local public safety entities to communicate with one another. Our ultimate goal is a more cohesive radio management program.

PUBLIC RADIO AND TELEVISION

Local communities are in the forefront of planning for extension of public radio and TV to Montana. We are, as the Montana Communications Study notes, currently unserved by Montana-based public television. Consequently, 20 Montana communities have filed applications with NTIA for public television construction grants. In the area of public radio, KUFM at the University of Montana in Missoula, will soon have expanded coverage to include the City of Great Falls and environs.

CONCLUSION

The most important result of the Montana Communications Plan has been the stimulation of dialogue and better understanding of the immensity and complexity of our communications network among State and local governments. This is leading to a more complete understanding of the need for comprehensive telecommunications planning and implementation of a cohesive, modern, and economical State telecommunications network. We have made an excellent start towards implementing many of the key recommendations contained in the study and anticipate continuing to move forward in these endeavors.

Sincerely,

Morris L. Brusett

Morris L. Brusett
Director

MLB/psb
encl.

VOLUME I

TABLE OF CONTENTS

	PAGE
Introduction	3
Telephony	5
Land Mobile Radio	16
Data Communications	19
Public Radio	24
Public Television	31
Video Equipment	41
Information Systems	49
Conclusion	52

MONTANA COMMUNICATIONS STUDY

INTRODUCTION

In 1980, the State of Montana's Telecommunications Advisory Council was awarded a grant from the U. S. Department of Commerce's National Telecommunications and Information Administration, Public Telecommunications Facilities Program for the purposes of a general inventory or overview of existing telecommunications facilities that are or might be available for public telecommunications use, an assessement of the needs of the State, and the development of a statewide telecommunications plan.

This final report of the Council covers the primary methods of telecommunications in Montana and reviews ways in which these, or new technologies can be expanded and improved to better serve the needs of the State.

The findings contained in this report represent the input of the citizens of Montana obtained through a series of public hearings held throughout the State, input of task forces organized to assist the Council in reviewing communications systems, and the work of a staff and consultants employed to conduct the research and prepare this final report. Public hearings were held in October - November, 1980, in Billings, Bozeman, Glasgow, Glendive, Great Falls, Havre, Helena, and Missoula.

Much work remains to be done. Telecommunications technologies, their costs and capabilities, as well as the legal and regulatory climate impacting on

them, are constantly changing. No single document can expect to present a complete analysis of this dynamic field. Planning for future telecommunications development in the State should, therefore, represent a continuous part of the State Government's concerns.

The funding, through the 1981 Legislature's House Bill 827, of a telecommunications planning unit as part of the Department of Administration's Communications Division is a positive step in this direction.

Detailed discussions, with recommendations for further action are presented in Volume I for Telephony, Land Mobile Radio, Public Radio, Public Television, Video and Information Systems. Volume II contains consultant's reports prepared as part of this study. These reports are solely the opinions and judgments of the consultants employed to produce them and are not necessarily the opinions or conclusions of the Montana Telecommunications Advisory Council or the State of Montana. These findings are presented with the hope that they will lead to a greater appreciation of the immensity of choices available to the State of Montana and its citizens and a careful pursuit of these choices for their benefit.

TELEPHONY

The Montana State Telephone System is a network of 19 switches located in 4 Montana cities which includes a switch in Helena. This network serves approximately 8,700 lines and 10,200 telephones. All of these, with the exception of a small switch in Kalispell, are leased from Mountain Bell.

Each city or circuit group within the State TELPAK system has a designated code for access to the tie lines which connect them with Helena. In addition, there are WATS (Wide Area Telephone Service) circuits which originate in Helena and serve all areas in Montana not connected by tie lines and the continental U.S.

Divestiture and Deregulation. On January 8, 1982, the U. S. Department of Justice and the American Telegraph & Telephone Company agreed to a settlement of the suit brought by Justice in 1974. Basically, the settlement allows AT&T to enter any new market it so desires in return for divestiture of all of its local operating telephone companies.

The major value of the new settlement, according to financial analysts, is that it removes restrictions from AT&T so that Bell can better plan its future. Bell services and products can no longer be delayed as easily as before by competitors through the regulatory process and the courts. "The final benefit should occur to the telecom user who will be offered more choices in the future as a result of competition, including those of AT&T, and a more rapid implementation of new technology".(1)

The competition for interconnection of telephone equipment from independent vendors to Bell equipment actually was initiated with the 1968 F.C.C. "Carter-

fone Decision", which ruled that the connection of non-Bell produced terminal equipment to the Bell System Network must be allowed, with the use of a protective interconnecting device. This not only established competition among companies connecting telephone equipment to the AT&T Network, but also accelerated the development of such advances as computer-controlled switching and private microwave transmission.

The effects of the new deregulation may include:

- increased rates for regulated transmission services, particularly local dial tone service and private line arrangements;
- increased rates for intercity private line services;
- increased local calling and short haul toll rates;
- a wider range of new and more cost effective services becoming available to end users.

Rising costs of telecommunications have caused a number of states to look closely at their telephone systems. New York State prepared a ten-year management plan for their state telecommunications facilities to contain their annual expenditures of over $100,000,000 per year.(2) The State of Washington recently acquired a private state telephone network projected to save about $5,000,000 annually in long distance costs. The State of Kansas proposed, in 1981, to replace their telephone transmission facilities with a state-owned fiber optic system, projected to avoid $50,000,000 over ten years in network costs.(3)

While, in the past, communications systems were justified on the basis of improved service to the user, future systems will also be justified on the

basis of reduced operating costs. It is imperative that the State of Montana study and determine the most suitable and cost-effective telecommunication systems for our situations. We recommend that the Communications Division develop such plans for the State Telephone System.

Needs Assessment. To determine the needs of the State's telephone system, the project surveyed administrators from around the State who are responsible for the management of their respective telephone systems, interviewed Helena based agency heads, and surveyed randomly selected agency employees. University and College representatives were also polled.

In general, some common areas of concern emerged from the four surveyed groups. Concern was expressed over escalating costs of the systems and it was constatnly noted that new systems would be required within three years or less.

The system administrators and the Helena personnel were also concerned with the difficulty in placing WATS calls. This was closely echoed by the general user and educational institution user difficulty in system busy conditions which includes WATS access attempts.

Telephone management problems, inadequate switch expansion capability, inadequate facilities (lack of cable), incorrect billings, and poor turnaround time were also regularly cited as problems.

In addition to the survey, the study examined specific problems within the Montana State Telephone System.

Funding and Management. The funding and management of the State switching

system is fragmented. The system, by authorization of the Montana Codes Annotated (Section 2-17-301) is to be administered by the Communications Division of the Department of Administration. However, only 3 of the 19 switches are directly managed by the Department of Administration. The remaining 16 are administered and funded through other agencies or institutes of higher education. A map showing switch locations is found on page 15.

The State also suffers from a lack of expertise in the telecommunications field. Switch managers are usually financial officers or physical plant managers untrained in telephony. The State does have managers at each of the switch sites but most of them have additional duties beyond their telephone responsibilities.

The level of manpower and education within the Division of Communications should be increased as soon as possible in the telephony field. Such expertise will require suitable salaries to retain.

Tariffs. Because the State leases equipment from common carriers (primarily Mountain Bell), it is subject to cost increases. Rates are approved by either the Montana Public Service Commission (PSC) or the Federal Communications Commission (FCC) in the form of tariffs. Between 1968 and 1979 Mountain Bell requested no tariff increases, however, applications for tariff increases are becoming more frequent in Montana.

Since 1979, three tariff increases have been requested by Mountain Bell. In each instance the PSC granted only a portion of the amount requested.

TABLE I

TARIFF SUMMARY: MOUNTAIN BELL

PASSED:	February, 1979	Series PBX increased 20%. First tariff since 1968. Requested: $11.8 million Granted: $ 3.3 million
	August, 1980	No direct impact on PBX system. Restructure of private line offerings and some terminal equipment Requested: $16.6 million Granted: $ 6.5 million
PASSED:	October, 1981	Series PBX increased 35%. Centrex PBX increased 25%. Interim increase of 3 million in April, 1981 Requested: $30.5 million Granted: $13.8 million
PENDING:	February, 1982	Requesting: $31 million. Will increase series PBX offerings 25%-40% Will increase Centrex PBX offerings 24%-39% Will increase tie line offerings 50%

An historical summary of tariff requests is shown in Table I.

The State would do well to remove itself from an ever increasing tariff situation in its telephone network. One way to accomplish this is through lease or purchase of switches. Both of these require a Request for Quotation (RFQ).

The State did issue a Request for Proposal (RFP) to various vendors in 1979 for lease of new switches at Helena, Bozeman, Billings and Missoula. Unfortunately, due to the brevity of the document and a lack of focus, the replies to the RFP were not able to be easily compared. After using a number of consultants to assist them in deciphering these responses, the State ultimately decided to reissue a Request for Quotation (RFQ) as a more carefully constructed document and process.

RFQ. The State should develop a standard RFQ which would retain basic contractual portions to be used throughout the system whenever switch replacement is required. With a standard form, only the system specifications would be changed to tailor fit the switch in question.

When requesting quotations, the State should also include mandatory contractual concepts and system capabilities such as the stipulation of fixed capital equipment costs, compensation for vendor non-performance, and the capabilities for the switches to account for their own line and set assignments to insure correct billings. A programmable switching system would save in labor costs system-wide and an automatic route selection capability should be considered which would select the cheapest route for long distance calls to be transmitted.

Additional Cost Savers. The State should consider requiring the local distribution networks serving the switches as well as constructing its own carrier mechanisms between the switches. Both would help to control costs.

System Growth. All systems have grown at the rate of twenty percent or less in 1980. In 1979-80, roughly twenty percent of all systems grew from 20-40 percent. The remaining systems grew at a rate of 20 percent or less.

In the last five years, 10 percent of all systems grew at a rate of 61-80 percent, approximately 20 percent of all systems grew from 40-60 percent, approximaterly 30 percent of all systems grew from 20-40 percent, and the remaining systems grew at a rate of less than 20 percent.

Main line growth is projected to be slow but steady for the next five years. Extension station increase is sharper from years three to five than for years one and two because an electronic switch is to be installed in Helena to replace the existing switch. This should increase the extension/station ratio.

Two-way trunks are expected to increase steadily at a rate of 4 percent per year, while one-way outgoing trunks appear to be increasing at a slower rate. The rate of increase for one-way incoming trunks is projected to drop slightly in the third year, but will recover to its original position shortly thereafter.

Dial-up computer ports are projected to increase more sharply than any other system component, 5 percent the first year, 6 percent the next year, and 7 percent for all years after.

Off-premise extension is expected to show a slower rate of increase in the third year than in the first two, but the rate of increase will recover to the second year level in years four and five.

Foreign exchange circuits (FXs) will increase slowly.

In general, the State can expect a steady growth in the telephone system over the next five years.

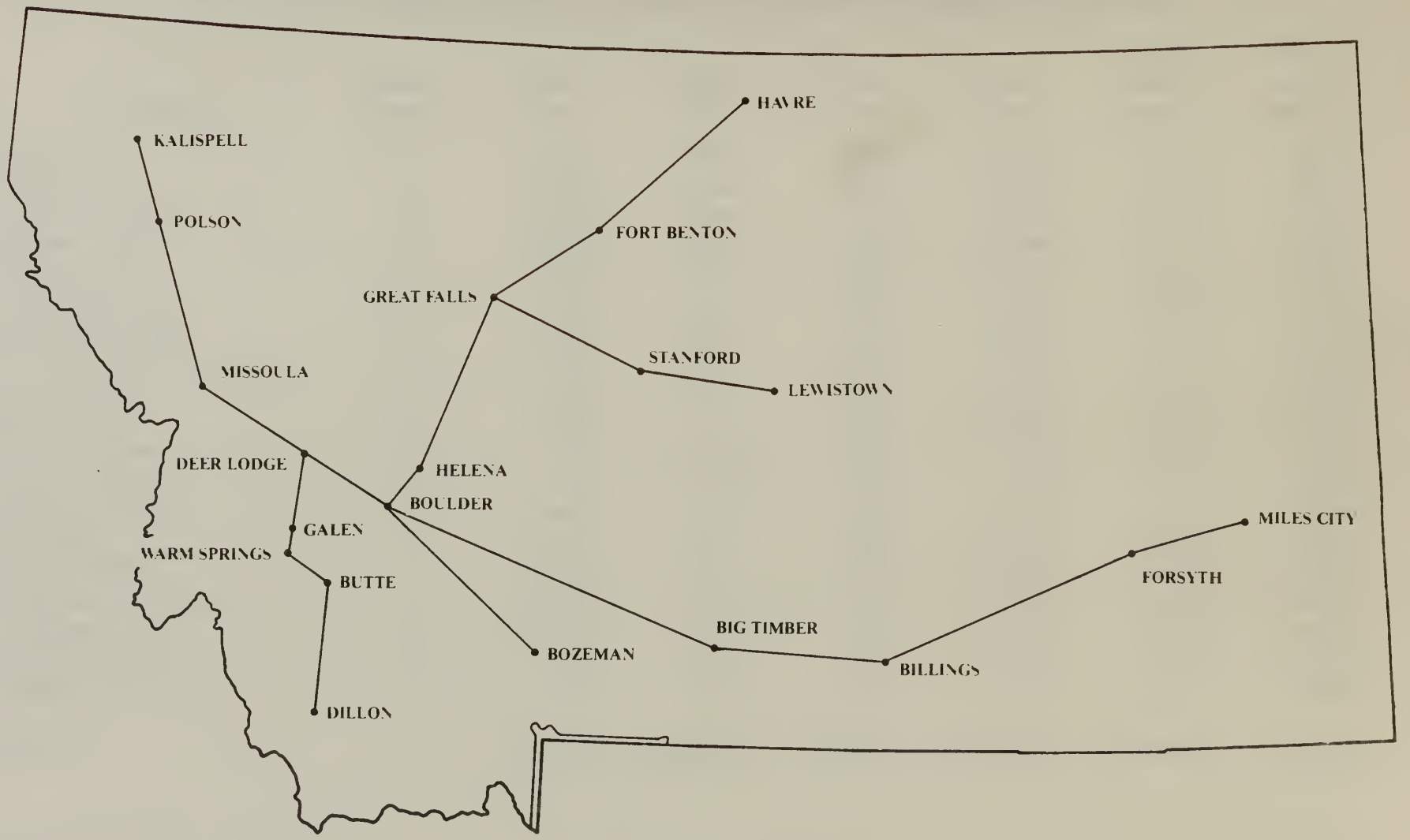
The following pages show the State TELPAK circuits. These lines are "grandfathered", i.e., cannot be extended beyond present locations. They enable the State to utilize heavy traffic routes at lower costs. However, as Table II (page 14) illustrates, we expect these lines to increase in cost. The pending February, 1982, tariff, if fully approved, could result in an increase of over 50% in these costs.

(1) Merrill, Lynch, Pierce, Fenner & Smith, Inc., "Telecommunications Industry", New York, February 18, 1982.

(2) State of New York, "Management Plan for New York State Government Telecommunications Facilities", Albany, January, 1982.

(3) State of Kansas, "Telecommunications System Plan", Topeka, 1981.

STATE TELPAK LINES
4-1-82



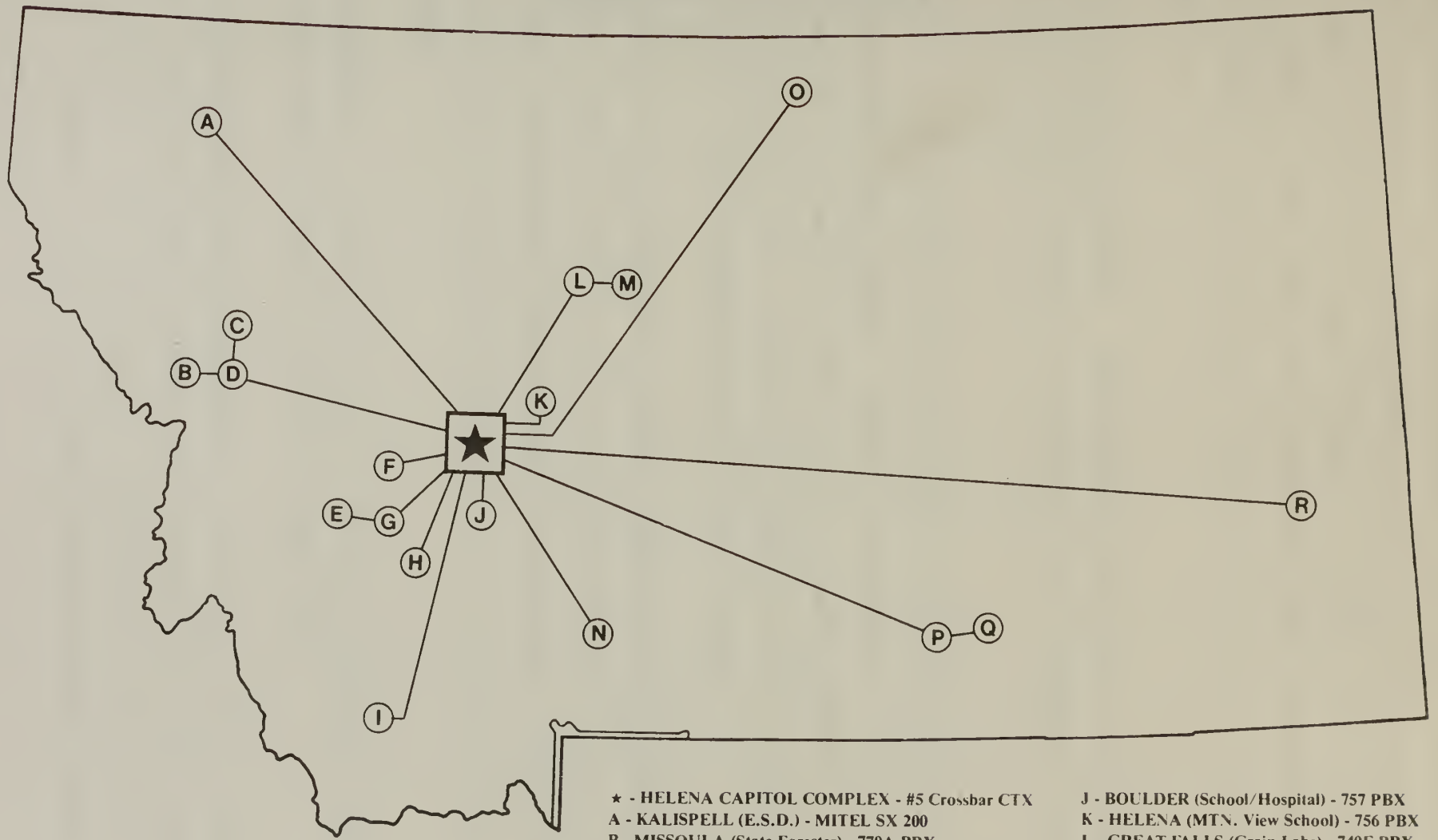
Prepared by Communications Division, April, 1982

COST OF STATE TELPAK LINES -
BASED ON MONTHLY LEASE PAYMENTS AS OF 4/1/82

LOCATION	Channel Capacity	Month Cost	1982 Cost	3-year Cost	10 year Cost	3 years @ 10% Inflation	10 years @ 10% Inflation
Boulder-Helena	240	1,389.96	16,680	50,040	166,795	55,211	265,836
Boulder-Bozeman	60	1,930.50	23,166	69,498	231,660	76,679	369,206
Boulder-Big Timber	60	3,207.60	38,491	115,473	384,912	127,405	613,447
Big Timber-Billings	60	2,079.00	24,948	74,844	249,480	82,578	397,607
Billings-Forsyth	24	2,280.96	27,372	82,116	273,715	90,600	436,232
Forsyth-Miles City	24	974.16	11,690	35,070	116,899	38,694	186,308
Boulder-Deer Lodge	240	1,710.72	20,529	61,587	205,286	67,951	327,179
Deer Lodge-Missoula	60	2,049.30	24,592	73,776	245,916	81,400	391,933
Missoula-Polson	24	1,378.08	16,537	49,611	165,370	54,737	263,557
Polson-Kalispell	24	855.86	10,270	30,810	102,703	33,994	163,677
Deer Lodge-Galen	60	475.20	5,702	17,106	57,024	18,874	90,875
Galen-Warm Springs	60	118.80	1,426	4,278	14,256	4,720	22,727
Warm Springs-Butte	60	564.30	6,772	20,316	67,716	22,415	107,928
Butte-Dillon	12	980.10	11,761	35,283	117,612	38,929	187,440
Helena-Great Falls	60	2,138.40	25,661	76,983	256,608	84,938	408,970
Great Falls-Fort Benton	12	659.34	7,912	23,736	79,121	26,189	126,097
Fort Benton-Havre	12	1,229.58	14,755	44,265	147,550	48,839	235,157
Great Falls-Stanford	12	997.92	11,975	35,925	119,750	39,637	190,851
Stanford-Lewistown	12	677.16	8,126	24,378	81,259	26,897	129,508
TOTALS		$25,696.94	$308,365	$925,095	$3,083,632	$1,020,682	$4,914,512

Prepared by Communications Division, April, 1982

MONTANA STATE TELEPHONE SYSTEM
AND
EXISTING SWITCHES



★ - HELENA CAPITOL COMPLEX - #5 Crossbar CTX
A - KALISPELL (E.S.D.) - MITEL SX 200
B - MISSOULA (State Forester) - 770A PBX
C - MISSOULA (E.S.D.) - 770A PBX
D - MISSOULA (Univ. of Montana) - NCX 23 CTX
E - GALEN (Hospital) - 770A PBX
F - DEER LODGE (Prison) - 770A PBX
G - WARM SPRINGS (Hospital) - 770A PBX
H - BUTTE (Mont. Tech.) - D400 FP4
I - DILLON (Western Mont. College) - 701 CTX
J - BOULDER (School/Hospital) - 757 PBX
K - HELENA (MTN. View School) - 756 PBX
L - GREAT FALLS (Grain Labs) - 740E PBX
M - GREAT FALLS (E.S.D.) - 770A PBX
N - BOZEMAN (M.S.U.) - 701 CTX
O - HAVRE (Northern Mont. College) - 770A PBX
P - BILLINGS (Eastern Mont. College) - 701 CTX
Q - BILLINGS (E.S.D.) - 770A PBX
R - MILES CITY (Pine Hills School) - 770A PBX

Prepared by Communications Division, April, 1982

LAND MOBILE RADIO

Land mobile radio systems are used more than any other type of communication in emergency situations. In Montana there are almost 9,000 public land mobile radios (LMR) in operation and over 500 transmitting sites. This inventory includes the radios at State agency and County level as well as University and College equipment. Table III provides a breakdown of State and local radio equipment.

Equipment Description and Use. Representatives from State, City, and County agencies were polled to determine equipment use and an assessment of their needs.

The average annual expenditure for LMR equipment replacement was $2,600. Twenty-six percent of the agencies' equipment was between one and five years old, 44 percent was between six and ten years old, and 30 percent was between eleven and twenty years old. On the average, agencies felt they should replace 81-100 percent of their equipment within the next 2.75 years.

Ninety percent of the respondents cited skip interference as the most common operational difficulty while 10 percent cited obsolescence of equipment as a major issue. Miscellaneous comments included the need for a uniform statewide service, the lack of statewide planning, and the desire to switch to high-band frequencies.

Needs Assessment. In addition to the poll, the study coordinators identified and examined areas of concern to land mobile radio users.

Skip Interference and High Band Frequencies. By using "low band" systems (between 30.56 and 49.6 MHz) the State agency systems suffer from intermittent skip interference. This interference is a naturally occurring phenomenon. At times it can become so severe it can actually prevent effective emergency services communications.

TABLE III

INVENTORY OF LAND MOBILE RADIO EQUIPMENT
STATE OF MONTANA and LOCAL GOVERNMENTS
March, 1982

STATE AGENCIES	LOW BAND	HIGH BAND	TOTAL
Base Stations	77 (73%)	28 (27%)	105
Vehicle Mobiles	1,221 (79%)	333 (21%)	1,554
Hand Carried Mobiles	183 (47%)	208 (53%)	391
Paging Receiver Mobiles	35 (78%)	10 (22%)	45
Control Stations	18 (90%)	2 (10%)	20
Control/Mobile Relay	-	7 (100%)	7
Mobile Relays	23 (82%)	5 (18%)	28
Repeaters	18 (95%)	1 (5%)	19
COUNTIES/MUNICIPALITIES/OTHER			
Base Stations	202 (47%)	229 (53%)	431
Vehicle Mobiles	2,267 (46%)	2,668 (54%)	4,935
Hand Carried Mobiles	596 (45%)	721 (55%)	1,317
Paging Receiver Mobiles	118 (18%)	546 (82%)	664
Control Stations	5 (29%)	12 (71%)	17
Control/Mobile Relays	36 (78%)	10 (22%)	46
Mobile Relays	4 (44%)	5 (56%)	9
Repeaters	1 (10%)	9 (90%)	10

Many land mobile radio users believe that the answer lies in a simple frequency shift to "high band" (150.8 to 162.0125). The study has received conflicting information on this point.

Some high band users report that they experience little or no interference while others note that they receive considerable interference, usually from relatively close locations such as northern Wyoming or southern Alberta. This would seem to suggest a close correlation between frequency levels and proximity of skip interference. Further examination of high band radio conversions should be explored. Table III shows present high and low band radio equipment.

Frequency Coordination. Frequency coordination between statewide users is poor. There is a need for better spectrum management in order to avoid over-use and overcrowding of frequencies, particularly since more and more users are in need of new frequencies each year.

Party Lines. In addition to poor frequency coordination, there presently exist few "party line" frequencies for statewide use. Introducing this system to a coordinated statewide frequency plan would refine the system even further.

This would probably require substantial replacement costs of radios from one-channel to two-channel models. But since another issue identified was the system obsolescence, the time may be ripe for major equipment changes along with frequency changes. This option should be explored under the statewide frequency plan to be developed by the Communications Division.

Site Sharing. The possibility of transmission site management and site sharing was also explored. The study has discussed the idea with Frederal government representatives and recommends that this should be pursued by the State and Federal government in the future to achieve cost effective use of facilities.

Growth Projections. Growth projections for land mobile equipment were difficult to obtain. However, it is assumed that the system will continue to grow. The State should gain control and provide coordination of this valuable communications resource. Otherwise, the situation will continue as it is, a multiplicity of users, each with their own frequency segment, suffering from interference, unable to communicate with each other, and providing less than optimum service to the general public.

DATA COMMUNICATIONS

The study worked extensively with the Data Communications Task Force, the Computer Services Division (CSD) within the State Department of Administration and the Institute for Telecommunications Sciences (ITS) within the U. S. Department of Commerce. Although precise data communications equipment levels were difficult to obtain statewide, the CSD did develop a general overview of the State agency equipment.

Inventory. As of March, 1981, State government possessed 4 distribution processors, 27 remote job entry terminals, and 357 terminals for a total of 388 devices. This figure does not include City or County level equipment nor does it include all equipment at educational institutions or libraries within the State. However, the CSD estimates that the State equipment comprises approximately 60 percent of existing data communications equipment in Montana. A map illustrating the present network is on page 22.

Needs Assessment. Four issues were identified by data communication users in the State as problems or areas of need or concern.

1. Local Distribution Costs. Data communication at the local level is accomplished by leasing circuitry from the common carrier, usually the Bell system. Leasing is relatively expensive and costs are difficult to plan for because of tariff increases granted by the Public Service Commission.

   There appears to be only one alternative to this, and that is for the

users to wire the site themselves. In 1979 Eastern Montana College began an on-site wired network, and Northern Montana College is considering rewiring their system. Additional on-site rewiring needs to be considered by other data processing users.

2. Unloaded Multi-Point Circuits. The State needs to transmit data to more than one location. To accomplish this, an "unloaded multipoint circuit" could be used. This is a circuit with its loading coils removed, which allows data to be transmitted over it at a higher rate: 9,600 baud as opposed to 2,400 baud. The multipoint circuit enables connection of more than one point of reception.

   At present Bell does not offer this service and has not filed a tariff to provide this service. Incorporation of multi-point circuits into the data transmission network needs to be researched.

3. Protocol Incompatibilities. Simply put, IBM central processors and terminals "speak a language" known as Systems Network Architecture, or SNA. Other data processing equipment, such as DEC and WANG, speak a language known as X.25. These two protocols differ enough so that communication between an X.25 terminal and an SNA processor is extremely difficult, if not impossible.

   Although it has been argued that in some instances it is better to have a decentralized system, the State's data communicating and data processing terminals and processors should all "speak the same language". There are two ways to accomplish this.

   The first is to control the procurement of all new data transmitting devices. This would require major legislative changes to make local

governments and educational institutions coordinate all data communications equipment procurements with the State government. It is estimated that using this method, it would take approximately 15 years to phase out the old protocol equipment.

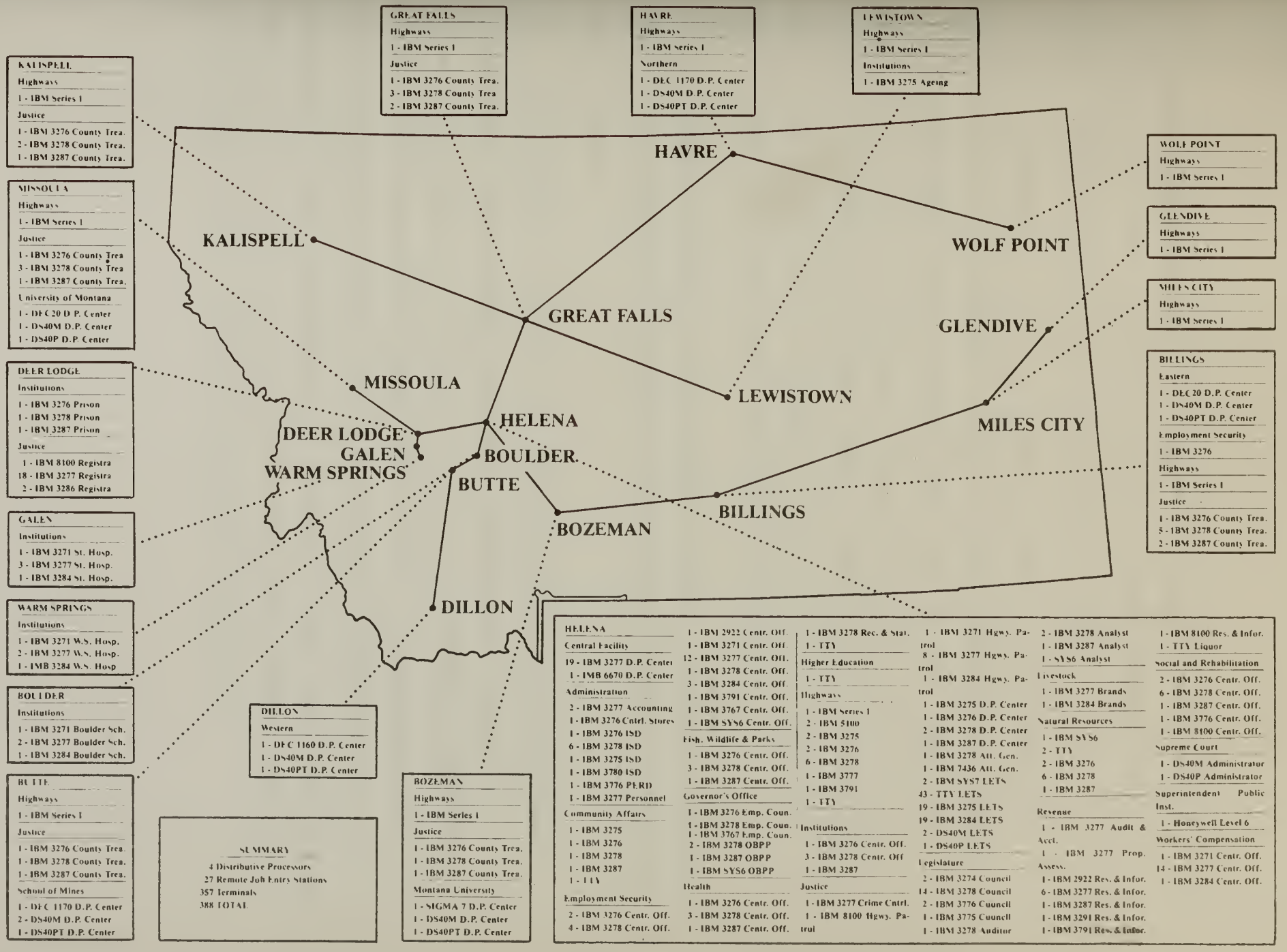
The second option is to allow the marketplace to solve the difficulty for the State. These same protocol incompatibilities exist throughout the date processing world, and there appears to be enough user pressure world-wide to motivitate manufacturers to work together to solve this problem. IBM, the creator of SNA, currently uses X.25 compatible protocols in their European markets and is reportedly expected to change to compatible protocol in the United States in the near future. Protocol compatibilities should be an important consideration when purchasing new equipment in the future.

4. Inventory of Equipment and Identification of User Groups. The actual inventory of equipment should be accomplished under the auspices of the Communications Division, and follow these guidelines:

- Coordinate closely with the Computer Services Division to avoid duplication of effort and equipment.
- Identify and utilize any other data bases regarding physical equipment.
- Devise and institute a volatile data base for this physical inventory, preferably to be maintained at a centralized point such as the Governor's Office or the Communications Division.

If handled properly, the inventory of the physical equipment should also solve the issue of identification of the user community.

MONTANA TELEPROCESSING NETWORK


KALISPELL
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea.
2 - IBM 3278 County Trea.
1 - IBM 3287 County Trea.
GREAT FALLS
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea.
3 - IBM 3278 County Trea
2 - IBM 3287 County Trea.
HAVRE
Highways
1 - IBM Series 1
Northern
1 - DEC 1170 D.P. Center
1 - DS40M D.P. Center
1 - DS40PT D.P. Center
LEWISTOWN
Highways
1 - IBM Series 1
Institutions
1 - IBM 3275 Ageing
WOLF POINT
Highways
1 - IBM Series 1
GLENDIVE
Highways
1 - IBM Series 1
MILES CITY
Highways
1 - IBM Series 1
BILLINGS
Eastern
1 - DEC 20 D.P. Center
1 - DS40M D.P. Center
1 - DS40PT D.P. Center
Employment Security
1 - IBM 3276
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea.
5 - IBM 3278 County Trea.
2 - IBM 3287 County Trea.
MISSOULA
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea
3 - IBM 3278 County Trea
1 - IBM 3287 County Trea.
University of Montana
1 - DEC 20 D.P. Center
1 - DS40M D.P. Center
1 - DS40P D.P. Center
DEER LODGE
Institutions
1 - IBM 3276 Prison
1 - IBM 3278 Prison
1 - IBM 3287 Prison
Justice
1 - IBM 8100 Registra
18 - IBM 3277 Registra
2 - IBM 3286 Registra
GALEN
Institutions
1 - IBM 3271 St. Hosp.
3 - IBM 3277 St. Hosp.
1 - IBM 3284 St. Hosp.
WARM SPRINGS
Institutions
1 - IBM 3271 W.S. Hosp.
2 - IBM 3277 W.S. Hosp.
1 - IMB 3284 W.S. Hosp
BOULDER
Institutions
1 - IBM 3271 Boulder Sch.
2 - IBM 3277 Boulder Sch.
1 - IBM 3284 Boulder Sch.
BUTTE
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea.
1 - IBM 3278 County Trea.
1 - IBM 3287 County Trea.
School of Mines
1 - DEC 1170 D.P. Center
2 - DS40M D.P. Center
1 - DS40PT D.P. Center
DILLON
Western
1 - DEC 1160 D.P. Center
1 - DS40M D.P. Center
1 - DS40PT D.P. Center
BOZEMAN
Highways
1 - IBM Series 1
Justice
1 - IBM 3276 County Trea.
1 - IBM 3278 County Trea.
1 - IBM 3287 County Trea.
Montana University
1 - SIGMA 7 D.P. Center
1 - DS40M D.P. Center
1 - DS40PT D.P. Center
SUMMARY
4 Distributive Processors
27 Remote Job Entry Stations
357 Terminals
388 TOTAL
HELENA
Central Facility
19 - IBM 3277 D.P. Center
1 - IMB 6670 D.P. Center
Administration
2 - IBM 3277 Accounting
1 - IBM 3276 Cntrl. Stores
1 - IBM 3276 ISD
6 - IBM 3278 ISD
1 - IBM 3275 ISD
1 - IBM 3780 ISD
1 - IBM 3776 PERD
1 - IBM 3277 Personnel
Community Affairs
1 - IBM 3275
1 - IBM 3276
1 - IBM 3278
1 - IBM 3287
1 - TTY
Employment Security
2 - IBM 3276 Centr. Off.
4 - IBM 3278 Centr. Off.
1 - IBM 2922 Centr. Off.
1 - IBM 3271 Centr. Off.
12 - IBM 3277 Centr. Off.
1 - IBM 3278 Centr. Off.
3 - IBM 3284 Centr. Off.
1 - IBM 3791 Centr. Off.
1 - IBM 3767 Centr. Off.
1 - IBM SYS6 Centr. Off.
Fish, Wildlife & Parks
1 - IBM 3276 Centr. Off.
3 - IBM 3278 Centr. Off.
1 - IBM 3287 Centr. Off.
Governor's Office
1 - IBM 3276 Emp. Coun.
1 - IBM 3278 Emp. Coun.
1 - IBM 3767 Emp. Coun.
2 - IBM 3278 OBPP
1 - IBM 3287 OBPP
1 - IBM SYS6 OBPP
Health
1 - IBM 3276 Centr. Off.
3 - IBM 3278 Centr. Off.
1 - IBM 3287 Centr. Off.
1 - IBM 3278 Rec. & Stat.
1 - TTY
Higher Education
1 - TTY
Highways
1 - IBM Series 1
2 - IBM 5100
2 - IBM 3275
2 - IBM 3276
6 - IBM 3278
1 - IBM 3777
1 - IBM 3791
1 - TTY
Institutions
1 - IBM 3276 Centr. Off.
3 - IBM 3278 Centr. Off
1 - IBM 3287
Justice
1 - IBM 3277 Crime Cntrl.
1 - IBM 8100 Hgwy. Patrol
1 - IBM 3271 Hgwy. Patrol
8 - IBM 3277 Hgwy. Patrol
1 - IBM 3284 Hgwy. Patrol
1 - IBM 3275 D.P. Center
1 - IBM 3276 D.P. Center
2 - IBM 3278 D.P. Center
1 - IBM 3287 D.P. Center
1 - IBM 3278 Att. Gen.
1 - IBM 7436 Att. Gen.
2 - IBM SYS7 LETS
43 - TTY LETS
19 - IBM 3275 LETS
19 - IBM 3284 LETS
2 - DS40M LETS
1 - DS40P LETS
Legislature
2 - IBM 3274 Council
14 - IBM 3278 Council
2 - IBM 3276 Council
1 - IBM 3775 Council
1 - IBM 3278 Auditor
2 - IBM 3278 Analyst
1 - IBM 3287 Analyst
1 - SYS6 Analyst
Livestock
1 - IBM 3277 Brands
1 - IBM 3284 Brands
Natural Resources
1 - IBM SYS6
2 - TTY
2 - IBM 3276
6 - IBM 3278
1 - IBM 3287
Revenue
1 - IBM 3277 Audit & Acct.
1 - IBM 3277 Prop. Assess.
1 - IBM 2922 Res. & Infor.
6 - IBM 3277 Res. & Infor.
1 - IBM 3287 Res. & Infor.
1 - IBM 3291 Res. & Infor.
1 - IBM 3791 Res. & Infor.
1 - IBM 8100 Res. & Infor.
1 - TTY Liquor
Social and Rehabilitation
2 - IBM 3276 Centr. Off.
6 - IBM 3278 Centr. Off.
1 - IBM 3287 Centr. Off.
1 - IBM 3776 Centr. Off.
1 - IBM 8100 Centr. Off.
Supreme Court
1 - DS40M Administrator
1 - DS40P Administrator
Superintendent Public Inst.
1 - Honeywell Level 6
Workers' Compensation
1 - IBM 3271 Centr. Off.
14 - IBM 3277 Centr. Off.
1 - IBM 3284 Centr. Off.
HAVRE
GREAT FALLS
WOLF POINT
KALISPELL
GLENDIVE
MILES CITY
MISSOULA
LEWISTOWN
HELENA
DEER LODGE
GALEN
WARM SPRINGS
BOULDER
BUTTE
BILLINGS
BOZEMAN
DILLON

Future Needs/Growth Projections. To assess future needs, the study relied heavily upon CSD's figures since they were able to provide estimates encompassing all agencies attached to the host processor at Helena.

CSD expects input/output terminals to increase from 400 to 1,000 devices between 1981 and 1985, or 150 percent. Batch transmission terminals are estimated to increase 140 percent, from 25 devices in 1981, to 60 in 1985. Modems will show a similar increase of 150 percent, increasing from 200 to 500 devices. Concentrators are expected to increase from their present level of none to five devices in the next five years. Dedicated and dial-up circuits, along with message switchers, all show trends of anticipated rapid growth.

The user community, in keeping with the equipment trends, is expected to increase approximately 50 percent from roughly forty user groups at present to sixty groups within five years.

Costs. CSD estimates an expenditure at present of roughly $670,000 per annum in lease costs of lines, modems, controllers, and terminals. This cost is expected to rise sharply within the next two years to an estimated $2,370,000 per year due to system expansions and increased lease costs. This increase can be reduced considerably according to the CSD by employing long range planning. The Communications Division should address the potential for cost-savings in examining alternatives for data transmission, since the primary cost increases are projected to involve lines, modems, communications controllers and terminals.

PUBLIC RADIO

Any radio station which does not air commercials, is at least partially funded with public money, and is associated with a public institution, is referred to in this report as a public radio station. Funding for operations comes from the private sector in the form of donations, from the government in the form of grants, or from semi-public groups such as a student body.

National Public Radio. For those unfamiliar with public radio, there may be a tendency to confuse the use of the term "public radio" with National Public Radio (NPR). NPR is not a radio station but a federally funded programming service which distributes its programs to affiliate stations. It is only one of many procedures for programming public radio stations, many of which are not affiliated with NPR. However, NPR is definitely the single largest source of public radio programming.

To become a member of NPR, stations must meet specific criteria established by the Corporation for Public Broadcasting (CPB). CPB is a private, non-profit, quasi-governmental corporation which receives most of its funding from federal appropriations. That money is in turn used to support NPR and NPR member stations. National Public Radio also provides funding for stations attempting to become NPR members by issuing expansion grants.

To become a member of NPR, CPB requires that stations meet the following criteria:

- Five full time paid staff (minimum wage).
- $100,000 annual income, from non-federal support. (This amount will escalate by $5,000 per year until 1983, and by $10,000 per year after 1983).

-Sufficient transmitting power to cover applicable community.

-Two separate control rooms and studios.

-On the air a minimum of 18 hours a day, 365 days a year.

-No commercial advertising.

There are other ways to receive NPR programming without becoming members. Any station may purchase from NPR non-timely taped programs for replay. Non-educational tapes cost about $12 - $18 each, and educational tapes start at $6. Stations may also sign an agreement with an NPR member station and NPR itself to acquire NPR feed from the local member station. The station affiliating with the local NPR member station is not required to meet the NPR membership criteria. Contributions made to the affiliated, non-member stations go to the local member station providing the feed which results in greater community service grant funds to the member station from NPT. The states of Minnesota, Wisconsin, and West Virginia have used this option to build statewide public radio networks affiliated with NPR.

Public Radio in Montana. There are currently six public radio stations broadcasting in Montana. Two stations, KUFM in Missoula and KEMC in Billings, are affiliated with NPR. Other stations are KNOG in Havre, KMSM in Butte, KGLT in Bozeman, and KHTC in Helena. All six stations are associated with a university, college, or vocational technical school and broadcast on the FM band. Of the six some are more appropriate than others for use in Montana. Maps showing current and possible radio coverage are found on pages 28-29.

Increase Transmitter Power. This alternative is not appropriate in Montana because of the State's terrain and sparse population. Since the FM signal travels

line of sight, no amount of power will beam the signal through a mountain or hill. Reception becomes impossible if there is any intervening terrain. Even in eastern Montana, where the land is relatively flat, there is still enough geographical variation to prevent 100 percent signal propagation.

Increase the Number of Translators. Translators are one means by which an FM signal can be widely distributed in mountainous terrain. Translators are installed on strategic points, i.e., mountain tops, and used to beam the FM signal from a main transmitter into a specific area or from translator to translator.

As the signal is passed from transmitter to the translator, some "spill" of the signal occurs along the route allowing those people in its path to pick it up.

The KUFM signal is broadcast to Helena and Butte via translators.

If KUFM in Missoula and KEMC in Billings were the only two originating stations, the installation of a microwave fed transmitter in Great Falls would permit good state coverage with the addition of translators. The number of translators needed would have to be determined by additional analysis.

Microwave Distribution with Local Transmitter. In this system, the FM signal is carried by microwave from the originating transmitter to a transmitter at the termination point. The system is the same as the transmitter-to-translator method except that signal distribution is by microwave. Once the signal is carried over the microwave unit from the originating station, it can be retransmitted at the terminal point. This system allows local programming insertion.

At each microwave repeater site, or nearby, it would be possible to install a

transmitter. Extension of the signal would then be by use of translators. If the State owned its own microwave system, costs could be relatively inexpensive.

Hard Wire Ties Between Stations. This system employs a telephone link between the originating station and the station being served. The radio signal is carried over a telephone line. Due to the correlation between the high cost of hard wire ties, and the great distances in Montana, this alternative does not appear to be feasible.

Bicycle of Tapes from Station to Station. Pre-recorded tapes are sent from the originating station to the receiving station. NPR has had difficulties with regulations regarding the transmittal of tapes from their stations, and the legal status of this system presently remains in limbo. Therefore it is difficult to determine how effective this system would be.

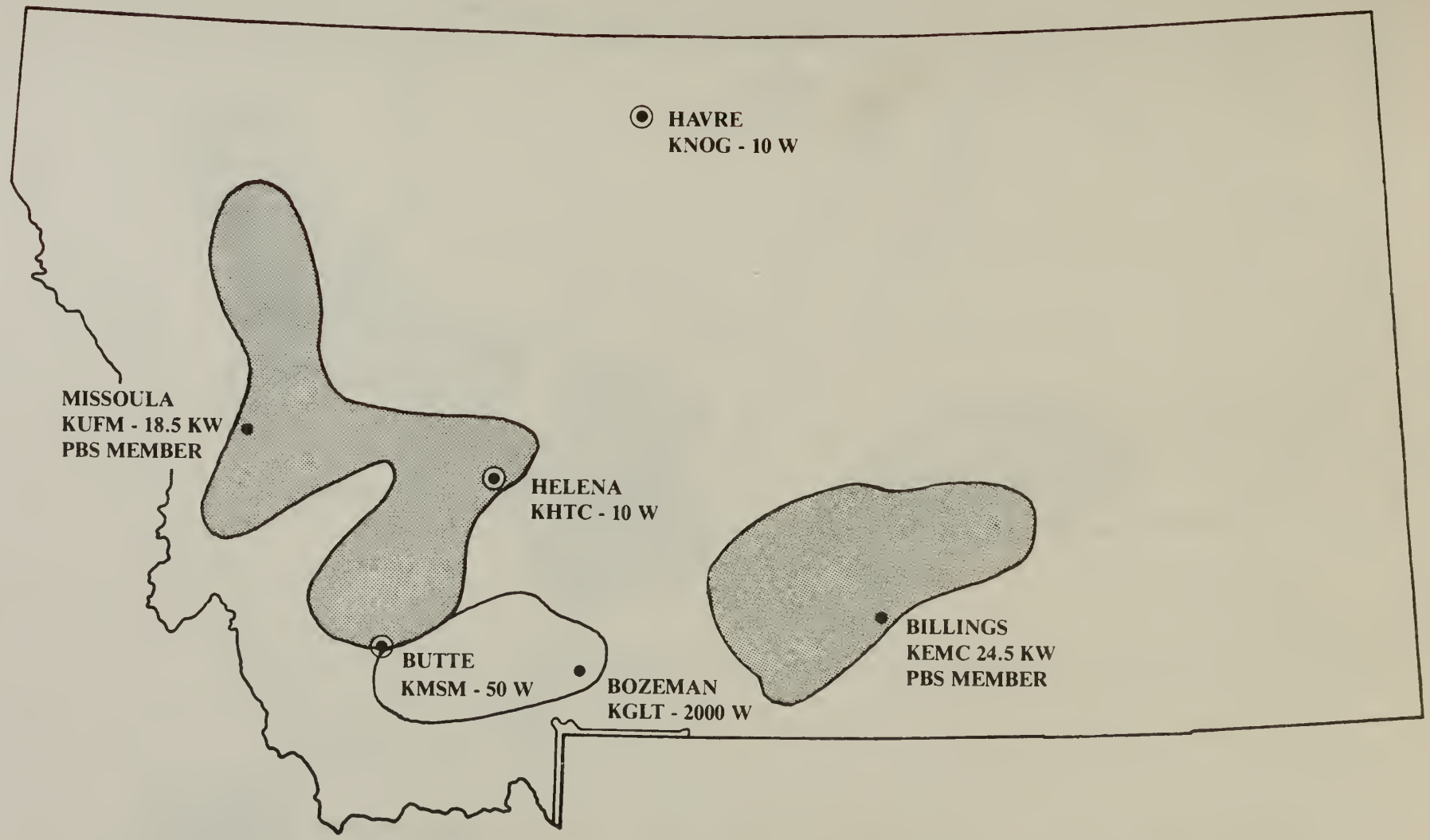
Copyright restrictions apply to much material provided by programming services such as NPR. Montana originated programming put out by Montana public radio stations would not be restricted for copyright reasons.

Use of Satellite Uplinks/Downlinks. In this system, a station leases a satellite audio channel or use of an existing satellite signal. An uplink capability allows the transmission of a signal to a satellite which is then returned to earth within the "footprint" (area covered) of the satellite. Uplinks may be purchased or leased.

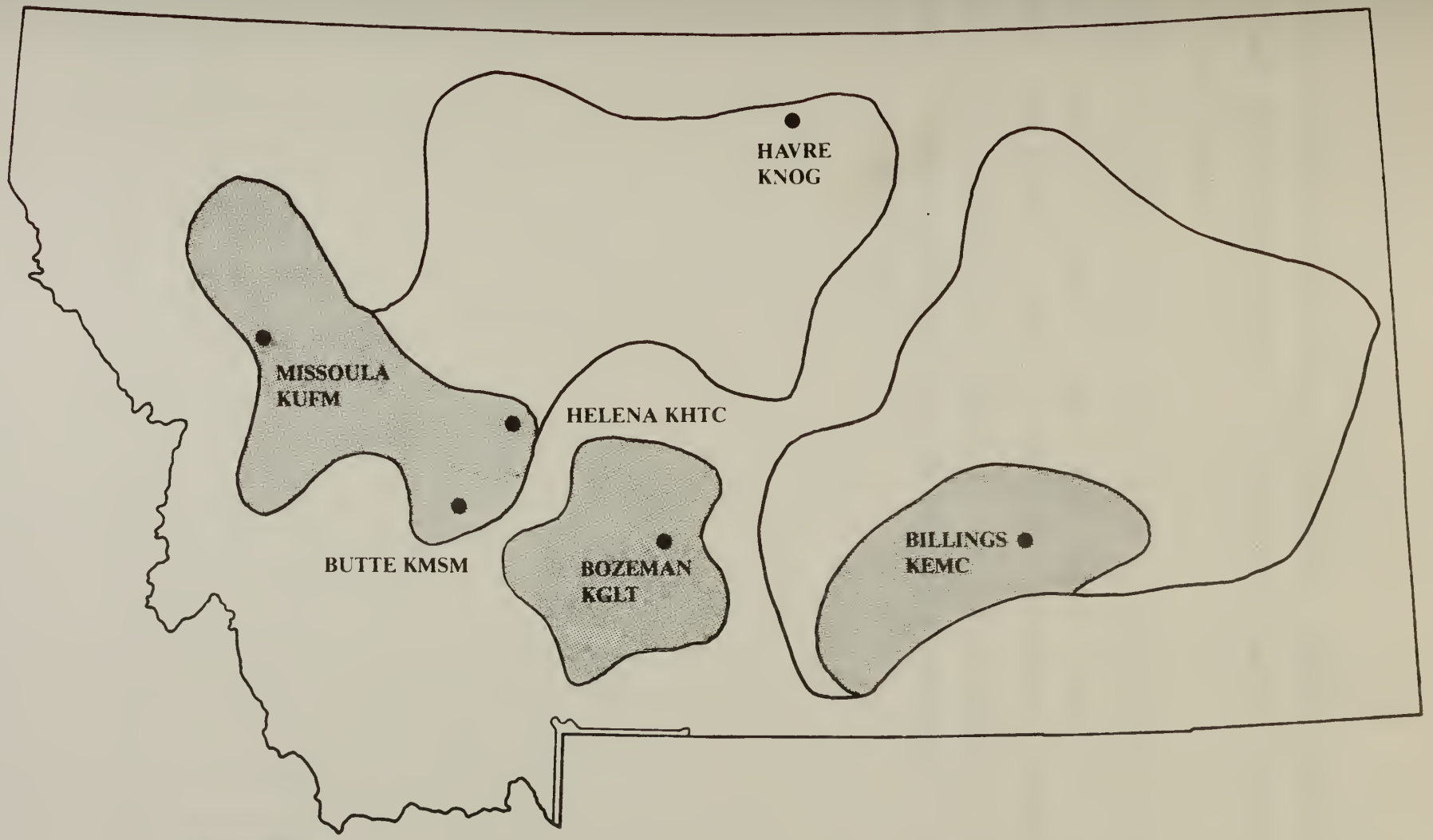
The existing NPR satellite signal is not formatted for direct rebroadcast. Formatting, scheduling, and fill-in by member stations are required by NPR.

PUBLIC RADIO - APRIL, 1982 COVERAGE

425,000 or 54% of 1980 population



POSSIBLE EXPANDED PUBLIC RADIO COVERAGE
APPROXIMATELY 85-95% TOTAL POPULATION COVERED



Current Coverage

Possible expanded coverage with KUFM retransmitted in Great Falls - 7-8 translators & KEMC using 10-12 translators

Currently the costs of a satellite are prohibitive. However, because there are so many breakthroughs occurring in this field, it may be a feasible alternative in the future.

Conclusion. Extension of public radio service to the remainder of the State's population may require extensive financing and decisions about the costs and benefits of the various technologies available to achieve this coverage. Further study is needed to determine the interests of unserved populations in public radio, the types of broadcasting desired, and the most appropriate means to finance and provide public radio services.

PUBLIC TELEVISION

Montana is one of two states that does not have a public television station capable of inserting local programming. Many Montanans, by subscribing to cable television, do receive Public Broadcasting Service (PBS) but these stations originate from out of state. The vast majority of Montana's geographical land area is unserved by any form of public television.

In 1974, the Montana Legislature sought to remedy this situation and created the Educational Broadcast Commission. The Commission was charged with promoting, establishing, and maintaining facilities to provide non-commercial television programs. For a variety of reasons, including conflict of interest allegations and excessive costs, this Commission was not continued. Since that time there has been no successful attempt to bring the public television issue before the Legislature.

In 1979, the Public Service Satellite Consortium, a non-profit, international organization, completed its own study of 17 rural Montana communities (along with communities in Wyoming and Appalachia) and their findings were similar. All of the sites surveyed which did not receive public television expressed an interest in it.(1)

Techncial Alternatives for Providing Public Television.

Broadcast. With this alternative, the feed control takes the produced programming and sends it to a high broadcast tower by cable or microwave. Equipment at the tower "powers up" the signal to 300 KW. The signal, which is now an "airwave", is received by a TV set antenna or a TV translator which conditions the signal and retransmits it on a different frequency.

A broadcast system to cover Montana would require seven high power broadcast

stations. They could operate independently or as a network linked together by microwave or satellite.

In addition, a number of translators would be required to reach rural areas or areas hidden by terrain. A high power signal can be translated three or four times.

The distance between a translator and a high power transmitter, or between translators, is determined by the frequency of the signal and line of sight. TV channels are broadcast on VHF (very high frequency) and UHF (ultra high frequency). As frequency goes up the signal assumes more of the characteristics of light, i.e., line of sight. VHF signals (channels 2-13) are lower frequency and therefore "bend" around hills. UHF (channels 14-69) does not. UHF is therefore not suitable for portions of Montana.

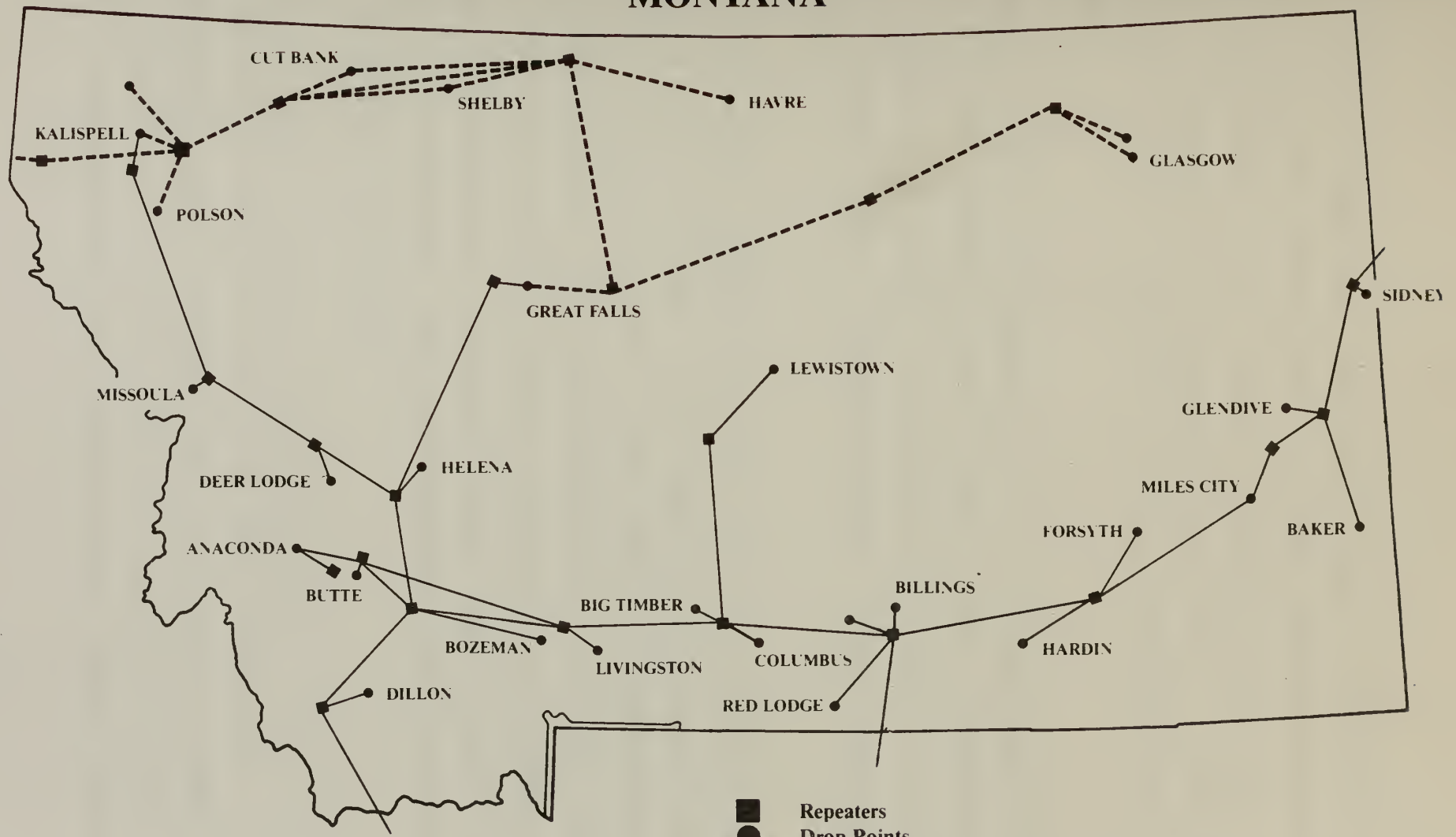
Microwave. In a microwave system produced programs are taken by feed control and transmitted by cable or microwave to a receiver. The signal is then retransmitted to the next microwave/receiver transmitter. The signal may be taken off the system at any microwave tower site.

There are currently three microwave common carriers operating in Montana: Western Tele-Communications, Inc., Intermountain Microwave, Inc., and Mountain Bell. Mountain Bell's system is primarily used for long distance transmission of voice channels rather than wide band video channels. (See map page 33.)

Intermountain Microwave, Inc. provides cable TV (CATV) service through Teleprompter, a subsidiary. Teleprompter provides CATV to the Highline communities, Great Falls, and the Missoula, Hamilton, and Kalispell areas. Teleprompter does not carry any public television channel.

Western Microwave, Inc. serves 22 communities in Montana which basically lie along

IN
MONTANA



Repeaters
Drop Points
Teleprompter (Intermountain Microwave, Inc.)
Western Microwave (Western Tele-Communications, Inc.)

Mountain States Telephone - No Information Available

April 1982

the I-90/I-94 corridor between Glendive and Missoula, plus Kalispell, Great Falls, and Lewistown. Western carries PBS station KUED from Salt Lake to all cable systems along its route. The cost of providing the PBS station is included in the basic monthly fee charged for cable service. It would not be technically difficult to insert Montana originated programming into the KUED schedule.

In addition, several private companies, most notably Montana Power and Burlington Northern Railroad, maintain microwave systems for in-house communications. MPC has cooperated with the State in microwave/radio site sharing in the past and will probably continue to do so. Burlington Northern's system is apparently strictly in-house.

With remote repeaters, Montana's two private common carriers could carry public television to the entire state. Mr. Del Matthis, general manager of Western Microwave, has suggested a public TV system known as the "Matthis System". This system would establish a studio and production facility to "strip" KUED (Salt Lake PBS) feed or take PBS feed off satellite, and provide such programming free to Western and Intermountain. The system would then expand by use of low power transmitters and TV translators. There would probably be no cost for the actual microwave transmission of the signal.

Satellite. Satellite systems are conceptually simple. An uplink sends produced programming to the satellite in the form of narrow microwave beam. The satellite equipment which receives the signal, called a transponder, retransmits the signal over a broad area. Earth dishes collect and concentrate the microwave signal which is then retransmitted over a microwave system, converted from microwave

frequency into the desired TV frequency and broadcast, carried by cable to viewers, or any combination thereof.

Reception and distribution of satellite programming may be decentralized in its operation and funding. It may also be done on a cooperative basis.

The University system in Nevada is organizing the "Nevada Plan". This system will consist of a computer managed central control facility in the Reno-Carson City area along with satellite receivers and low-power broadcast transmitters in approximately thirty rural communities in Northern Nevada. The signal received will be broadcast to the community along with local programming and news.

The technology presently exists to broadcast programming by a satellite, or series of satellites, and receive the signal on a small dish in the home. The home unit consists of a roof mount antenna as small as three feet wide, and the electrical equipment necessary to convert the microwave signal into a TV signal. Japan has such an experimental system in place, and several American firms are applying to the FCC for permission to create such a system in the U.S.

Costs. Of the three major signal distribution technologies considered, the broadcast scheme would clearly be the most costly. Depending on the scheme used, and whether or not local programming is considered crucial, either satellite or microwave is the least expensive. It is probable that plans like Nevada's and Alaska's will drive public television costs down in the future.

Production Capabilities and Equipment Holdings. Regardless of what technology is employed to provide public television to Montana, programming must first be produced. Because PBS is the largest non-commercial producer and program buyer, most public

television stations are PBS affiliates. However, not all public television is PBS. Programs can be produced by non-profit foundations, commercial producers, universities, and a large number of independents. Independents include local citizen groups, government funded cultural groups, special interest groups, and others. Even if affiliated with PBS, stations can preempt PBS programming and insert programming produced by others or themselves.

The project surveyed existing facilities and inventoried holdings to determine what production capabilities are currently available within the state. Use of television/video technology was also examined. The following are results of that survey.

Commercial Broadcast Facilities. Six of the eleven television stations in Montana are owned by two networks. Montana Television Network owns KSLF (Butte), KTVG (Billings), KRTV (Great Falls), and KPAX (Kalispell). Eagle Communications owns KECI (Missoula) and KCFW (Kalispell). The remaining stations, KULR (Billings), KFBB (Great Falls), KOUS (Hardin), KTCM (Helena), and KYUS (Miles City) are either locally owned or are the only stations representing a corporation's activity in Montana.

Every station can field two cameras for studio production. The main line camera technology is state-of-the-art. Main line video tape machines show some differences which reflect an individual station's production philosophy.

Three stations, KOUS, KYUS, and KCFW, rely exclusively on 3/4 inch video machines. The remaining stations rely on 1 inch or 2 inch technology. Within the Montana Television Network there is a movement toward installing the new 1 inch helical scan technology.

All stations can now play back 3/4 inch tapes and time base them for broadcast

purposes. With few exceptions, broadcasters also have 3/4 inch editing suites for their news gathering efforts.

Montana television stations do not consider themselves production houses. Stations seldom act as contracted producers. As small market stations, their local public affairs programs and production for advertisers effectively ties up most of their production capacity. They will produce special programs but only if the program has some utility for their service area.

Independent Producers. Eight independent production facilities were sampled to assess the overall state of the independent production art. Three of those interviewed began as film production houses while the other five began with television technology.

In general, production houses hold inexpensive 3 tube cameras. All respondents produce in 3/4 inch format, though editing is done either on 3/4 inch, 1 inch or Quad.

Independents support their efforts in a variety of ways. The three companies who transferred their activities to video are using television technology to service clients who originally used films. One company also produces its own properties for distribution to the educational/industrial market. The remaining companies rely on contracts to make expenses.

Of those surveyed, the former film companies are the longest lived and report a larger percentage of revenue from out of state contracts. The companies which began in video are younger and rely on local revenues.

One duplication house, North Country in Great Falls, reports a state-of-the-art multiple format facility. North Country edits on format Helical, can dub to Quad, all U-Matics, and 1 inch. They also have a well developed electronic field

production van. Like the film companies, most of North Country's revenues come from out of state activities.

Cable T.V. There are currently 2,564 miles of cable in Montana. The number of households served is 126,356. This could be increased by as much as 30 percent without the addition of more transmission cable if people were willing to pay for the service.

The cable systems in Montana receive programs from satellite, microwave, or off-air transmission from local television broadcast. Additional programming can be taken from either video tape delay or local origination cameras, but in Montana more than 98 percent of all programs are taken from the first three systems.

Of the 49 cable companies in Montana, all but four have a parabolic antenna for receiving satellite transmissions. 83 percent have either a 4.5 or 5.0 meter parabolic dish with the range between 4.5 to 10 meters. 98 percent have a single dish, the remaining 2 percent have two satellite antennas for those systems receiving direct satellite transmissions.

Production capabilities of most Montana cable systems are limited. There are two camera studios with video editors, mike mixers, lights, character generators, and limited special effects. These two studios could produce a program for either live or tape delayed airing. There is also a portable studio used for legislative interviews every other year.

One cable company has access to production equipment, however, it is used only for local program promotion to increase system subscription.

Other than legislative interviews, there are two other forms of local programming available in Montana. The first is a variety show produced by a volunteer in Polson. This program is aired three to six hours a week.

The only other "local programming" provided is time and temperature status. 36 percent of the cable companies provide this service. The remaining 64 percent do not originate local programming of any type.

All of the systems perform maintenance and slightly more than half are able to repair most equipment failures themselves. However, only 7 percent of the systems are able to repair major equipment failures on site and 47 percent must send all non-functioning equipment to another location in the state, or out of state, for repair.

Most systems, both small and large, have equipment that measures line levels, or signal strength. This equipment is fairly inexpensive and can be used without a high degree of technical training.

The level of managerial and technical skills of individuals working within the cable systems are important because it is their skills which will make use of video telecommunications in the future a success or failure.

Managerial strength is strong, with the average manager having 10.4 years in the cable television business. All of the managers were enthusiastic about their work and the cable television business, and "espirit de corps" is strong for both large and small companies. It was also noted that working with satellite technology added excitement to the job.

And for the most part, the technicians interviewed also have a good background in cable systems. Nearly half of the technicians (47 percent) were trained in technical school and 28 percent received electronic training in one of the armed services. Twenty-two percent of the technicians gained their experience through on the job training. Six percent hold bachelors degrees in electronics. It was also noted that they enjoy their work and the cable television business.

Although 31 percent of those companies surveyed reported a lack of space, this situation was in most instances a temporary one due to system rebuilding. Fifty percent noted a lack of technical personnel, 54 percent said they were waiting for FCC deregulation to add additional program channels to their systems.

Few systems (less than 5 percent) reported high rates of equipment failure. All noted that the new solid state equipment was superior in operational time to equipment that used vacuum tubes.

All of the systems have just finished a major rebuild and added additional program channels or are planning to do so in the next six months to a year. Seventy-seven percent of the systems carry, or can carry, twelve channels. The remaining 23 percent offer twenty or more channels. In the next two years nearly 80 percent of all cable systems will offer more than 35 channels. A few systems may opt for as many as 55 channels. FCC deregulation will give many systems the green light to increase the number of channels as well as allowing them use of the "mid-band", the frequencies between channels 7 and 8.

Future expansion plans include the addition of another parabolic receiving

antenna. For the most part Montana cable systems are not planning to add additional square footage or increase staff by more than two people during the next year. Thirty-one percent said they planned to add one or two people to their staff in the next year.

(1) Public Service Satellite Consortium, "Public Television Service in Rural America", Washington, D.C., January, 1979.

VIDEO EQUIPMENT

A survey was conducted of video equipment owned by State agencies and universities. The intention was to identify the availability of equipment, its use, and potential for sharing with other agencies.

State Holdings. Of the 43 television sets reported, few are E.F. channel receivers exclusively. Agencies prefer full television monitors. 29 are black and white, 14 color, screen size averages in the high teens, and of brands listed Japanese models outnumber domestic brands 14 to 1.

50 video machines are distributed throughout the agencies. One old format BVH 1 inch Sony was reported, as were 17 1/2 inch reel-to-reel black and white machines. 30 3/4 inch cassette color machines and 2 1/2 inch color casette player/records were also listed.

One reel-to-reel 1/2 inch black and white editing system was reported at the Training Rehabilitation Information Center, Social Rehabilitation Services. One 3/4 inch editing system was reported by the Renewable Energy Bureau at Conservation and Natural Resources.

41 television cameras were listed, 13 of which were color. The majority of these are held by the Employment Security Division in its Job Service and Training offices. 10x1 lenses were scarce with 4 - 6x1 lenses dominating.

With the exception of Fish, Wildlife and Parks, no sophisticated tripods were reported. Very few agencies have adequate lighting, though most video users have microphones.

Respondents use their equipment for in-house training, documenting speakers, making public service announcements for television, making television documentaries or preparing television presentations for public meetings. Two-thirds of the respondents use television for at least two of these purposes. Almost half stated three uses.

The project inquired into frequency of use of major equipment items. Patterns of response indicate that television is used primarily for playback of pre-recorded material.

In contrast to video machines and monitor use, no agency reported daily camera uses. This may be due to the fact that only one agency has a full time staff member to operate video equipment.

The majority of the color cameras reported are held by Labor and Industry, hence black and white television production predominates among respondents. While most respondents report holding 3/4 inch color cassette video machines, the majority of these are old format, having non-standard color frequency signals and velocity problems. Such timing errors do not cause problems for industrial use, but are problems when a recorded signal has to be time base corrected for broadcast. The new 3/4 inch machines do not have these problems.

Few agencies reported having set aside permanent viewing or production space,

although most have furniture to move the equipment within the agency.

From survey answers, it is obvious that the use of television technology is simple and straight forward. The most extensive utilization was found within the Department of Labor and Industry, Social Rehabilitation Services, and in the hospitals administered by the Department of Institutions.

In most instances the respondents expressed the desire to upgrade their old formats rather than expand their holdings.

Those who do not have equipment frequently borrow it from other agencies. Conditions placed on lent equipment are not stringent although several agencies reported bad experiences with lending and have limited access to their equipment or have required the borrower to use the gear within the agency premises.

The respondents surveyed were aware that television offers cost savings. The importance which respondents placed on savings depended upon what each was doing with its individual programs.

Lack of personnel hampers television use more than lack of technology. All the respondents voiced the awareness that television production requires a variety of skills which personnel hired for non-television tasks seldom have to any degree. Given tight budgets, the respondents were not optimistic that personnel problems will be solved.

The priority rating given television was universally reported as "low". When

budget cuts have to be made it was indicated that television hardware is one of the first victims.

While the principle of sharing was commonly agreed upon, needs particular to each agency qualified that agreement. Scheduling editing is not as critical a demand problem to respondents.

The project also surveyed 35 and 16mm holdings. With few exceptions, all respondents own and use the 35mm format. Compared to only one staff member in video production, ten agencies reported staff assigned to produce 35mm materials. A few respondents reported contracting out 35mm work.

Two agencies reported 16mm holdings. The Fish, Wildlife & Parks has extensive holdings and has staff assigned to produce public service announcements, at least one documentary for television per year, documentation of field work, and production of public education materials. Their equipment and accessories are of fine professional quality.

University Holdings. Surveys were made of the state's six university units, Montana State University (MSU), Western Montana College (WMC), Montana College of Mineral Science (MCMS), Eastern Montana College (EMC), University of Montana (UM), and Northern Montana College (NMC).

Equipment holding have been classified as coherent or incoherent. Coherency has been defined as the ability to tape, edit, and duplicate video programs on

the same format machines in either black and white or in color. Acquisition patterns are termed coherent if they evidence attention to such factors as compatibility of formats, potential for aggregating to more sophisticated systems, and awareness of state-of-the art patterns in industry.

With the exception of WMC, all units of the university system can produce videotape coherently in black and white (B&W). B&W holdings are old, but still used for videotaping lectures, group therapy, and other similar applications. Respondents indicated that color would not add appreciably to the final product.

Coherent color production occurs at three units: the two universities and Northern Montana College. They all produce and edit in 3/4 inch format. MSU also produced coherently in 1 inch Ampex C format. Eastern Montana College and Montana Tech have color production capabilities in various formats.

Only the two university units reported sophisticated hardware. Both have studio and field portable 3 tube cameras with 10x1 lenses, control track editing, time base correction with title generation, and multiplexers.

Coherence of acquisition patterns is evidenced at the two universities, Northern, Western, and Montana Tech. While Western has a simple system, it was purchased with coherence in mind. Northern's system is 3/4 inch format with expectations of upgrading with newer versions of present holdings.

Montana Tech has delayed purchase of new systems until quality television hardware declines in price. That has now occurred to Montana Tech's satisfcation, and discussion is now underway concerning upgrading their system.

Western plans to install an integrated television system in the near future.

Traditionally, television has been assigned a dual mandate within the university system. First it must serve as a tool to instruct students in the use of television technology and secondly it must act as an instructional tool for academic departments. In addition, television in tax supported institutions is also expected to be available for public service in one form or another. Units within the university system have addressed these issues in individual ways.

The University of Montana divided television effort into the academic department of Radio-Television and a production component in Instructional Materials Service (IMS). The primary purpose of both units is the support of academic functions and both perform their roles harmoniously. In addition, both have supported grant projects which are considered extra-academic and have made services and hardware available for non-academic public service projects.

Generally, support for instructional efforts is concentrated at the IMS and the Radio/TV department, which holds the most coherent television equipment, supports an academic effort. However, where the IMS is not able to provide instructional support to a department, Radio/TV assists.

Television production under grants is generally done by Radio/TV. While the department is subsidized for its academic efforts, a larger percentage of its television revenues derive from grants and their non-academic production.

The Radio/TV department has no published rate card. When time allows it is willing to help with a project, with charges depending on time available and

the ability of the prospective user to pay. The department does not compete directly with independent profit production houses. It will deliver its services only if the job cannot be done elsewhere.

At Montana State University the Television Center is the major service deliverer of television. Some hardware is located in Secondary Education but is primarily of a record/playback nature without coherence.

For the support given to the Film/TV degree program the Center is subsidized but this income is not sufficient to cover all expenses. For that reason the TV Center has been recently redefined as an independent production unit and is actively seeking projects outside the University. Like UM, the TV Center will not engage in productions which compete with private houses and although they have developed a rate card, their rates are negotiable.

At Northern Montana College television is used for documentation by various academic departments. Personnel within the audio-visual department is not always adequate, however, some instructors have learned to be their own producers. More use would be possible if funds were available to allow faculty release time to develop educational software.

At Montana Tech television is viewed as a way to give highly abstract course material perspective and enrichment. They are developing an integrated approach to use television as an interactive tool for instruction. A studio classroom is planned with a two camera production capability.

Patterns of use at Western Montana College are determined by the lack of sophis-

ticated format. An adequate studio space is available for documenting lectures and other information, and the equipment is portable. When needed, the college borrows a 3/4 inch color machine from the local hospital.

Eastern Montana College is the only unit surveyed which has non-coherence in both its instructional effort and equipment acquisition. The Instructions/ Development Center at Eastern has coherent B&W production capabilities with 3/4 inch and 1/2 inch record/playback which supports the instructional efforts of departments without video holdings. The Center also has the best lecture hall observed with two 35mm back screens behind the podium, mic and slide switching from the podium, and excellent accoustics. To date, they have not had the resources to adapt the hall for video. The Center also recently lost a studio production area and having won approval for a large screen projection system, has no place to house it.

Even though the Instructional Development Center has the ability to deliver coherent services, in the last few years departments have been acquiring their own holdings which represent better technology than that held for the Center. Eastern has the most incoherent, most duplicative, and most wasteful system observed within the university system and departments of state.

INFORMATION SYSTEMS

Communications systems and networks are no more than vehicles designed to enable the transmission of information from one point to another. Development of a cohesive state telecommunications network would enable a more effective communication of information throughout the State. Such networks would also be designed to incorporate other communications methods such as electronic mail and teleconferencing.

This report barely scratches the surface of the future. The use, for example, of full color video teleconferencing, linking 20, 30, 40 communities together, may not be that far into the future. Such systems are developing in an incremental fashion. Priorities for scarce financial resources need to be established, but awareness of the potential of the communications revolution needs to be constantly attuned to new developments and ideas, particularly as these become more and more reliable and cost effective.

Examples of some of these types of communication are already at work in Montana. Acronyms such as AGNET and METS identify two of these examples.

AGNET. AGNET, the Agricultural Computer Network, is a pilot project funded by the Old West Regional Commission, extending this 20-state agricultural information system to Montana, South Dakota, North Dakota, and Wyoming.

Remote computer terminals are located in 47 Montana communities, through agents' offices for the Cooperative Extension Service. The AGNET system is for farms and ranchers, homemakers, Extension agents and specialists, vocational agricultural instructors, researchers, students in agriculture, home economics, and

business, and others. It enables access, through remote terminals, to programs enabling users to identify such information as simulation and economic analysis of cattle in a feedlot; breakeven yield and price analysis between crops; and determination of irrigation costs for surface or center pivot. (See map page 52.)

METS. METS, the Montana Educational Telecommunications System, is an audio teleconferencing network operated by Eastern Montana College in Billings. METS operates a Darome 2020 Meet-Me-Bridge, an electronic device enabling 20 separate stations to participate in a single conference. These conferences can be convened on a statewide, regional, national or international basis.

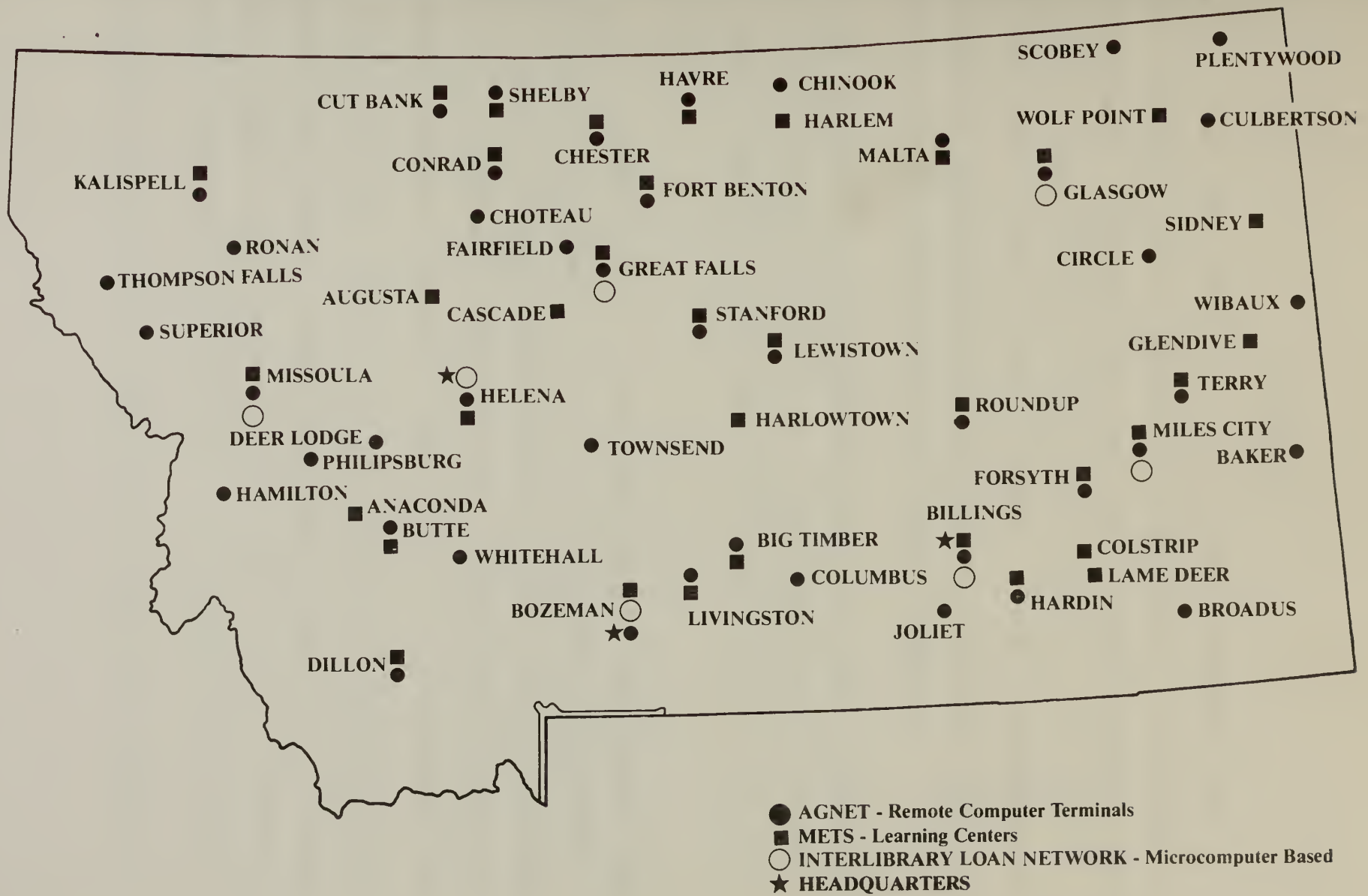
One of the primary functions of the METS at the present time is providing educational courses to learning centers established at 35 communities and equipped with Darome 610A, 624A conveners with simplex voice activated microphones.

Teleconferencing can be arranged by advance reservations and several conferences can be convened simultaneously through the EMC system. (See map page 52.)

Libraries. The Montana Public Library system, the Montana State Library, the State Law Library, and public and private libraries at colleges and universities are additional sources for information and resources continually expanding their services. The Montana State Library, for example, uses microcomputers to request inter-library loans among seven inter-library loan network (federation) members. They are used for other electronic mail applications as well, sending rush letters, informal questionnaires, meeting agendas, etc. (See map page 52.)

These are examples of resources which for the most part presently represent parallel information systems, but which could in the future form components of a comprehensive coherent information systems network.

SELECTED INFORMATION NETWORKS



CONCLUSION

Montana's vast, rugged terrain, and sparsely populated community creates special advantages as well as problems in the management of its telecommunications networks. Technologies can be more easily implemented when considerations of volume are concerned, and often at less cost than in more densely populated states. On the other hand, the burdens of initial investments and maintenance of communications systems that must serve the State's 147,000 square miles present special technical and financial constraints.

The State government's telecommunications network must attempt to address the dual problems of reaching out to all of its constituents while at the same time constantly maintaining these communications at the lowest cost to its taxpayers.

The State Telephone System is the single most expensive communications network operated by State government. The impacts of deregulation and divestiture make it especially urgent that this system be examined in detail for possible future system modifications and cost savings. Qualified staff and resources need to be available to the State in order to accomplish this responsibility.

Land mobile radio communications requires upgrading and a management plan to assure that this system is kept up-to-date and is a cohesive, cost effective network of State and local governments. This network requires the ability of its users to have effective, interference free, interagency communications.

The projected high costs of data communications require sound management of

this communications program. Rapid technological advances in electronic data processing and data communications require that system-wide planning govern future expansion and modification of this critical communications network. Each of the communications systems employed by State government needs to be considered part of an overall information system network. Planning and future management of this network must be conducted in a comprehensive manner.

Public radio and television were special concerns of the Council. Large portions of the State are unserved by either broadcast media. Their availability on a statewide basis would greatly enhance the educational and cultural opportunities for remote Montana communities. However, decision about the desirability of public radio and television are truly community-based decision and require extensive local input. The broadcast technologies are available, but extensive case by case study would be required to precede their realization.

Montana must decide which components of the communications system should receive priority and what the most effective means to address communications issues should be. This is a challenge requiring the attention of all of us.

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